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ABSTRACT

Before an item bank is constructed, several curriculum and testing considerations should be addressed. Such issues include the number of students enrolled in the selected subject area; number of desired objectives and items per objective; method of storing the items; and how and when to train how many teachers in item writing. The following steps are then used for construction and quality control of the item bank: (1) training teachers in writing test items and item specifications--this usually involves two days of orientation followed by a month of item writing; (2) review and revision by a panel of qualified persons; (3) assembly and field testing of experimental tests, including attention to format and printing; (4) item analyses, using both Rasch and traditional procedures, followed by the removal of inappropriate items; and (5) item bank maintenance using a readily accessible computer system. These procedures are used in the Dade County, Florida Public Schools for item banks in the following curriculum subjects: geometry, algebra I, life science, biology, and American history. (Appendices include a test item evaluation check list, sample item specifications, an answer sheet, and item statistics). (GDC)

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ITEM BANKING PROCEDURE AND QUALITY CONTROL IN DADE COUNTY PUBLIC SCHOOLS

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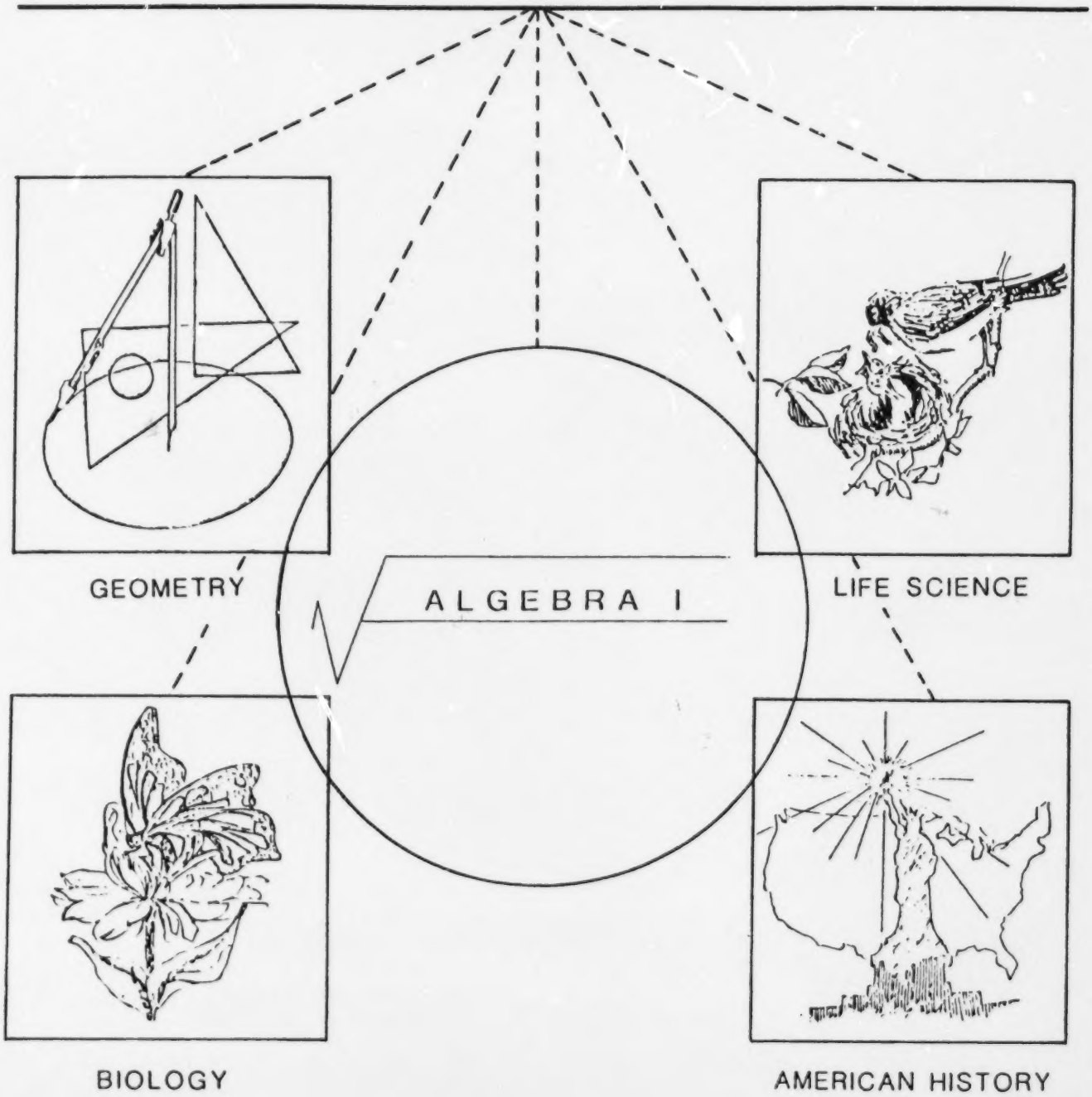
Paper presented at the annual meeting of
the American Educational Research Association
Chicago, Illinois
April 1985

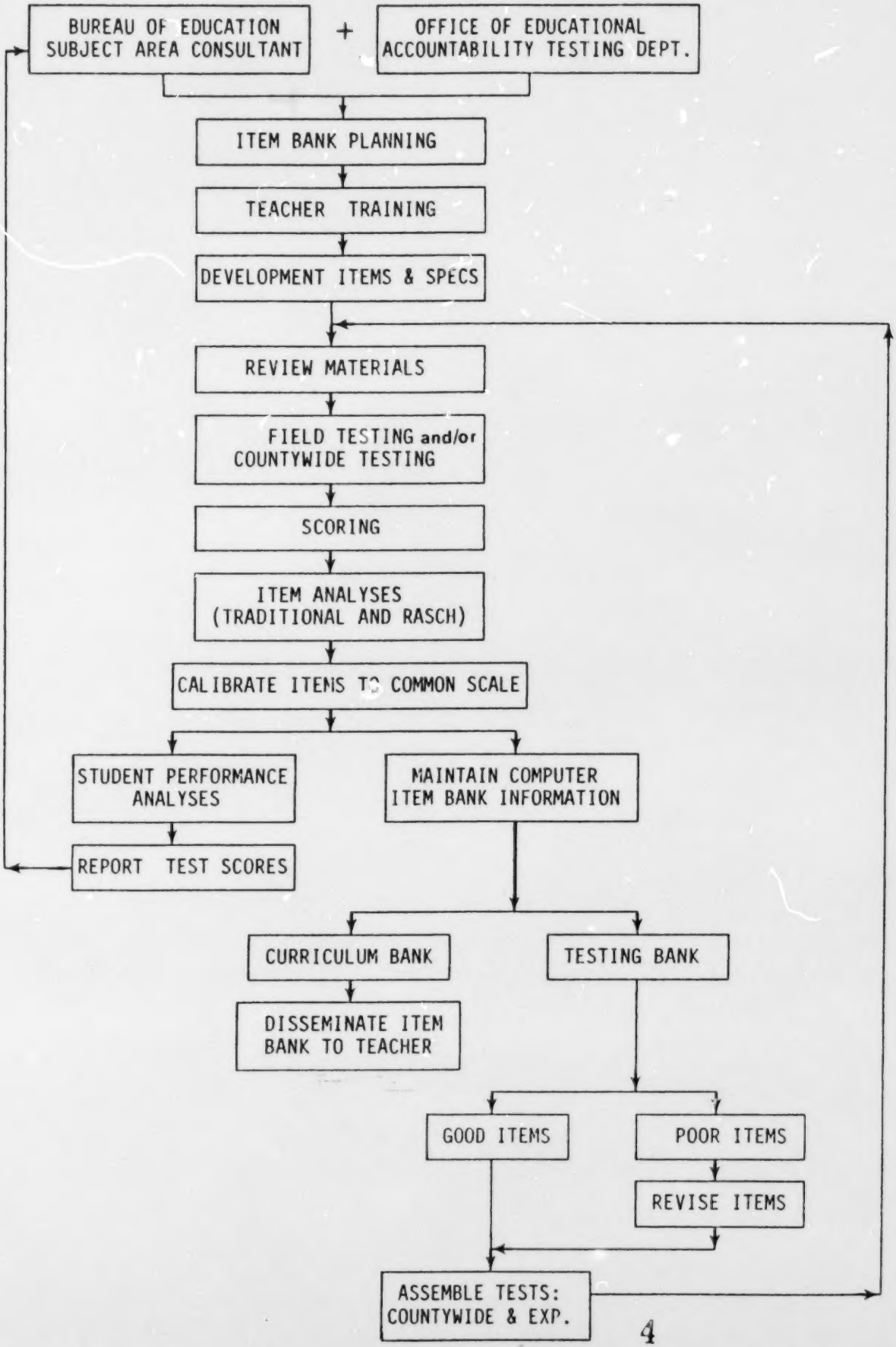
TM 850 507

ITEM BANKS

Dade County
Florida



ORGANIZATIONAL STRUCTURE FOR SUBJECT AREA ITEM BANK



Item Banking Procedure and Quality Control in Dade County Public Schools

Yuwadee Wongbundhit
Dade County Public Schools

Before one can construct an item bank, several curriculum and testing considerations should be addressed. These are:

1. What subject area should be selected for item banking?
2. How many students, on the average, are enrolled in the selected subject area?
3. What and how many objectives should be included in the bank?
4. How many items per objective should be developed?
5. How are the items to be stored?
6. When is the appropriate time to train teachers to write test items and item specifications?
7. How should the training workshop be conducted?
8. What is the minimum number of teachers needed for a writing team?

A close working relationship with the subject area curriculum supervisor can be a valuable asset in addressing these considerations.

The following steps are procedures for item bank construction and quality control of the item bank:

1. TRAIN TEACHERS IN WRITING TEST ITEMS AND ITEM SPECIFICATIONS

Before the actual writing of test items and item specifications begins, teachers should have received a basic orientation. This orientation should involve the fundamentals of test item writing and should include practice in writing items.

The orientation typically lasts 2 days at a centrally located site. The actual item writing may occur off-site over an extended period of time. At designated points in the month-long writing process, teachers work should be reviewed by the project manager. In this way, quality and progress can be monitored, and feedback can be given to teachers on a timely basis. An example of a typical item specification with a sample item is displayed in Appendix A-1.

2. REVIEW MATERIALS

Regardless of the care taken in the selection of item writers and the quality of training provided, test items and item specifications are very likely to require a series of revisions which should include a review by (1) measurement specialists, (2) curriculum specialists, and (3) reading specialists. Finally, all items should be reviewed by a panel of qualified persons to check for bias and to confirm the answer key. A review worksheet is displayed in Appendix A-2.

The revision of the materials is a crucial step that is needed in order to insure the quality of the product. The materials may go through several cycles of editing, rewriting, and reviewing. This is a very time consuming process; as much as 70% of the total project time can be utilized. It might require a full-time specialist to oversee and manage these activities. Without these activities, however, there is little assurance of the appropriateness and quality of the material.

3. ASSEMBLE EXPERIMENTAL TESTS AND CONDUCT FIELD-TESTING

After the items have been reviewed, 250-350 items should be assembled into approximately 10 test forms for field-testing. Between 250-400 students should be tested on one of the forms. Imbedded in each test is a core of items common to all of the test forms. These common items serve as a way of gauging difficulty for all of the items across the various forms.

Quality control measures during the field-testing phase are as follows:

1. Each test form should cover a sufficient set of course objectives, and test administration time should coincide with a classroom period. An example of a typical test specification is displayed in Appendix A-3.

2. Common items should be selected to insure that they represent the objectives covered by the test. Poor common items may adversely affect the value of the adjustment index.

3. Printing and test formatting should be clear and attractive to the examinees. The time and effort expended in test construction should not be compromised by poor layout or print quality.

4. ITEM ANALYSES

Both Rasch and traditional procedures are used to compute the item statistics needed to evaluate items. There are certain factors that need to be controlled in order to maintain quality at this step of the test development.

1. Answer sheets with unusual response patterns should be deleted, e.g., answer sheets with a "Christmas tree" pattern in the responses. An example of an unusual response pattern is displayed in Appendix A-4.

2. Answer sheets with an inadequate number of responses should be deleted. A rule of thumb is to delete any answer sheet that exhibits an omit percentage rate of 85% or more. However, based on the data and level of difficulty of the test, this figure may be adjusted upward or downward.

3. Answer sheets, which after analysis, show misfit responses to the Rasch model should be rejected. An example of this misfit is displayed in Appendix A-5.

4. The base scale of the bank must be carefully selected. A recommended method for selecting the base scale is to identify which test contains the highest quality items.

5. All poor common items must be deleted before determining an adjustment factor.

If all of the above factors are not controlled, then the results will reflect the old story of garbage-in-garbage-out.

5. ITEM BANK MAINTENANCE

Once the items have been calibrated onto the base scale, all item data is stored in a readily accessible manner. The quality of the development of future tests from the item bank depends on the ability to access this information. In Dade County, modifications have been made to some common computer programs, such as BICAL, in order to store item data such as the specification code, the sample size, the test date, and the item statistics on the mainframe computer. An example of a printout of item data is displayed in Appendices A-6 and A-7.

SUBJECT AREA ITEM BANK CHARACTERISTICS

The following are descriptions of some general characteristics of subject area item banks in Dade County Public Schools:

1. The initial size of an item bank for a subject area is designed to cover an entire annual course in a selected subject area. For example:

   The Algebra I item bank consists of 89 item specifications and 273 test items including sample items. The American History item bank consists of 65 item specifications and 430 test items including sample items.

2. All items are developed, edited, revieved for bias, and/or revised to satisfy content standards. Trained Dade County Public School teachers perform these functions. Additionally, measurement reviews are required.

3. Each item, with the exception of sample items, is field-tested with approximately 250-400 Dade County students.

4. Each item within the bank is calibrated onto a common Rasch scale.

5. Published item bank books are disseminated to teachers for classroom use. A part of this book includes a portion of the field-tested items. The other portion of items are kept secure for constructing future districtwide subject area tests.

6. The original size of the item bank can be expanded by embedding new items into the regular test. These new items are also calibrated onto the scale referenced in the bank.

7. Based on these thorough procedures, the time needed to construct each item bank is approximately 2 years.

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SUBJECT AREA TEST CHARACTERISTICS

The following are descriptions of some general characteristics of subject area district tests in Dade County Public Schools:

1. The content covered by the tests is the entire course objectives of the particular subject area.

2. The two-equivalent-tests procedure is used in order to cover a sufficiently large part of district course objectives.

3. The two alternate tests are linked to the reference scale in the bank. This feature allows for comparison of scores across forms.

4. Test lengths are determined according to the amount of time in a single classroom period. For example, in a 60-minute class period, the length of a test with a reading format, such as a history or English test, should be approximately 50 items. The length of a test with a computation format, such as an algebra or geometry test, should be approximately 45 items.

5. Items in the tests must meet content and statistical standards.

Appendix

ALGEBRA 1 ITEM SPECIFICATIONS

SPEC CODE VII - B1(B)

SPECIFICATION DESCRIPTION
VII Polynomials
B Operations
1 Laws of exponents
(B) $a^m \cdot a^n = a^{m+n}$

GENERAL DESCRIPTION
The student will be able to apply the property $a^m \cdot a^n = a^{m+n}$.

STIMULUS CHARACTERISTICS

FORMAT:

A polynomial is given in the form of $a^m \cdot a^n$ requiring the student to express it as a single power.

CONTENT:

1. Bases (a) may be a variable or a positive integer less than 10.
2. Exponents (m, n) may be variable or a positive integer less than 10.

INSTRUCTION:

Express $(a^m \cdot a^n)$ as a single power.

RESPONSE CHARACTERISTICS

FORMAT:

Expression in exponential form.

OPTIONS:

1. The correct response, and
2. The incorrect responses obtained by:
   a) multiplying bases
   b) multiplying exponents
   c) subtracting exponents
   d) multiplying bases and exponents.

SAMPLE ITEM:

00. Express $7^2 \cdot 7^3$ as a single power.

A. 7^{-1}

*B. 7^5

C. 7^6

D. 49^5

E. 49^6

AMERICAN HISTORY TEST ITEM

Author _____ Skill Code _____

Review Section

Please answer the following questions.
Use Y or N for your responses.

1. Does item adequately measure skill? ___
2. Is item difficulty appropriate? ___
3. Is question stated clearly? ___
4. Are item directions clear? ___
5. Does item format follow spec? ___
6. Does item content follow spec? ___
7. Are the grammar and spelling correct? ___
8. Is there only one correct answer? ___
9. Is the correct answer keyed? ___
10. Are the foils appropriate? ___
11. Are the options in logical order? ___
12. Does the item give clues or information that could be perceived as beneficial or detrimental to specific cultural or racial groups? ___
13. Does the item give clues or information that could be perceived as beneficial or detrimental to either sex? ___
14. Considering the specific content of the course outline, prioritize the item as to your recommendation for usuage on a field-test using a scale of 1 to 5 (1 = most important 5 = least important) ___

****

Reviewer 1 _____

Reviewer 2 _____

Reviewer 3 _____

EXPERIMENTAL TEST SPECIFICATION FORM

SUBJECT AMERICAN HISTORY FORM C

ITEM NO.	SKILL CODE	ITEM CODE	KEY	COMMON ITEM	COMMENT	ITEM NO.	SKILL CODE	ITEM CODE	KEY	COMMON ITEM	COMMENT
1			A			26	37	02	C	X	
2			C			27	37	01	C		
3	1	06	D	X		28	42	07	A	X	
4	1	04	B			29	43	01	C		
5	3	04	A			30	47	04	C	X	
6	4	08	B	X		31	47	02	B		
7	6	03	C	X		32	50	05	B	X	
8	6	02	A			33	50	06	D		
9	8	07	D	X		34	54	07	D		
10	8	06	C			35	B-15	07	A		
11	A-02	01	D			36	B-15	05	C		
12	A-02	07	A			37	58	06	C	X	
13	11	01	D	X		38	57	02	C		
14	10	09	A			39	59	03	B		
15	12	08	C			40	65	02	C	X	
16	15	02	A			41	65	07	C		
17	19	01	B	X		42	61	02	B		
18	17	05	D			43	67	01	C		
19	23	03	B			44	70	07	A	X	
20	24	01	D			45	69	07	C		
21	28	05	D			46	71	04	A		
22	31	07	D	X		47	77	01	C	X	
23	31	04	D			48	73	05	C		
24	A-25	05	A			49	76	02	A		
25	25	03	B			50	79	03	B		

KEY DISTRIBUTION

Choice	Tally	Total
A	~~HHT HHT~~ I	12
B	~~HHT HHT~~ III	13
C	~~HHT HHT~~ III	13
D	~~HHT HHT~~ III	13
E		

51 81 03 B

52 B-35 04 A

BEST COPY AVAILABLE

BEST COPY AVAILABLE

PRINT YO IE IN THE BOXES PROVIDED, THEN BLACKEN THE LETTER CIRCLE WHICH MATCHES EACH LETTER OF YOUR NAME.

LAST NAME: F C I : X

FIRST NAME: H e b e r t

MI

STUDENT'S NAME | SCHOOL | COURSE NO.

DADE COUNTY PUBLIC SCHOOLS

Subject Area Test: GEOMETRY

5/84

SECTION NUMBER

SEQUENCE NUMBER

STUDENT I.D. NUMBER (7 DIGITS ONLY)	SCHOOL	GRADE	FORM	SUBJECT AREA	COURSE CODE NUMBER
7 9 0 4 8 6 7	- - 1 1	11		2	2 2 1 5 7 1

1 a b c ● e	21 ● b c d e	41 ● b c d e	61 ● b c d e
2 ● b c d e	22 a b c d ●	42 a ● c d e	62 a ● c d e
3 a ● c d e	23 a ● c d •	43 a b ● d e	63 a b ● d e
4 a b c ● e	24 a b c d ●	44 a b c ● e	64 a b c ● e
5 a b ● d e	25 a b c ● e	45 a b c d ●	65 a b c d ●
6 a b c ● e	26 a b c ● e	46 a b c ● e	66 a b c ● e
7 a b c ● e	27 a ● c d e	47 a b ● d e	67 a b ● d e
8 a b c d ●	28 a b ● d e	48 a ● c d e	68 a ● c d e
9 a ● c d e	29 a ● c d e	49 ● b c d e	69 ● b c d e
10 a ● c d e	30 ● b c d e	50 a ● c d e	70 a ● c d e
11 a ● c d e	31 ● b c d e	51 a b ● d e	71 a b ● d e
12 a b ● d e	32 a ● c d e	52 a b c ● e	72 a b c ● e
13 a b ● d e	33 a b ● d e	53 a b c d ●	73 a b c d ●
14 a b c ● e	34 a b c ● e	54 a b c ● e	74 a b c ● e
15 a b ● d e	35 a b c d ●	55 a b ● d e	75 a b ● d e
16 a b c d ●	36 a b c ● e	56 a ● c d e	76 a ● c d e
17 a b ● d e	37 a b ● d e	57 ● b c d e	77 ● b c d e
18 a b c ● e	38 a ● c d e	58 a ● c d e	78 a ● c d e
19 ● b c d e	39 ● b c d e	59 a b ● d e	79 a b ● d e
20 a ● c d e	40 a ● c d e	60 a b c ● e	80 a b c ● e

A-4

NCS Trans Op-tr EB18-13985:321

MIS-23103 (12-8

PATTERN OF CORRECT ITEM RESPONSES
FOR RASCH MISFIT PERSONS

ITEM NUMBER		ITEM P-VALUE	ITEM DIFF	PERSON 1	PERSON 2	PERSON 3
10	EASY	.95	-2.92	+	*	*
13		.89	-2.17	*		
04		.86	-1.80	*		
08		.84	-1.64			
20		.83	-1.58			
29		.81	-1.46		*	*
02		.80	-1.36	*		*
15		.79	-1.27	*		
23		.78	-1.22			
17		.71	-0.86	*		
28		.69	-0.71			*
19		.63	-0.43		*	*
12		.63	-0.40			
16		.61	-0.35	*		
01		.60	-0.27	*		*
21		.60	-0.26	*		
11		.59	-0.25			
27		.54	-0.02			
26		.54	0.00			
31		.48	0.27			
34		.47	0.31			
24		.46	0.34	*		
07		.44	0.44	*		* +
09		.43	0.47		* +	
14		.38	0.71		* +	
22		.38	0.74			
25		.27	1.29	* +	* +	
03		.26	1.34			
30		.26	1.36	* +		
35		.25	1.42		* +	
06		.24	1.48			
33		.22	1.57			
18		.16	2.01		* +	* +
32		.11	2.49			* +
05	HARD	.09	2.75	* +		
Total of correct answers				13	8	9

ITEM STATISTICS OF GEOMETRY ITEM BANK (TESTING) MAY 1984
ITEM SPECIFICATION CODE XI-B(1-3)

ITEM NUM	ITEM CODE	PERCENT OF RESPONSES 1	2	3	4	5	OMIT	ITEM KEY	P VALUE	ADJ. DIFF.	ITEM STD ERR	TOTAL FIT	STD ERR TL FIT	PT. BISRL	NUM TRY	TEST DATE	SAMPLE SIZE	TEST FORM
1	0028T	10	16	34	35	3	3	4	0.347	0.576	0.110	0.940	0.069	0.447	1	MAY84	424	1
2	0056T	5	12	25	12	44	2	5	0.440	0.278	0.100	0.907	0.065	0.477	1	MAY84	475	2
3	0106T	38	15	9	28	7	3	4	0.277	1.161	0.121	0.917	0.070	0.462	1	MAY84	411	4
4	0107T	5	57	9	11	14	3	2	0.574	-0.329	0.110	0.916	0.070	0.511	1	MAY84	411	4

GEOMETRY TEST FORM 1

SPEC CODE: XI-B(1-3) ITEM CODE: 0028T

ITEM NUMBER 28

****

TEST DATE: MAY84 SAMPLE SIZE: 424 TRY OUT #: 1

ITEM STATISTICS

PERCENT RESPONSE TO EACH ALTERNATIVE	1 10	2 16	3 34	4 35	5 3	OMIT 3

CORRECT ANSWER	4
P-VALUE	0.3467
ADJ. DIFFICULTY VALUE	0.5762
ITEM STD ERROR	0.1105
TOTAL MEAN SQUARE FIT	0.9402
STD ERROR TOTAL MEAN SQ. FIT	0.0687
POINT BISERIAL CORR.	0.4471